CLAIMS

What is claimed is:

1. A method for brightness and contrast normalization in appearance-based object detection, the method comprising:

extracting a plurality of training images;

finding eigenimages corresponding to the training images;

receiving an input image;

forming a projection equation responsive to the eigenimages;

solving for intensity normalization parameters;

computing the projected and normalized images;

computing the error-of-fit of the projected and normalized images;

thresholding the error-of-fit; and

determining object positions in accordance with the thresholded error-of-fit.

2. A method as defined in Claim 1 wherein finding eigenimages comprises:

sub-sampling the training images;

forming training images of coarse resolution in accordance with the sub-sampled images;

computing eigenimages corresponding to the training images of coarse resolution;

interpolating the eigenimages for coarse resolution;

performing orthonormalization on the interpolated images by singular value decomposition; and

providing pseudo-eigenimages corresponding to the orthonormalized images for a finer resolution.

3. A method as defined in Claim 1 wherein at least one of said plurality of training images and said input image comprises a single-photon emission computed tomography image.

4. A method as defined in Claim 1 wherein the computed error-of-fit is represented by a score image.

5. A method of forming eigenimages for multiresolution, the method comprising:

sub-sampling a plurality of training images;

forming training images of coarse resolution in accordance with the sub-sampled images;

computing coarse eigenimages corresponding to the training images of coarse resolution;

interpolating the coarse eigenimages for a finer resolution;

orthonormalizing the interpolated images; and

providing pseudo-eigenimages corresponding to the orthonormalized images for a finer resolution.

6. A method as defined in Claim 5 wherein orthonormalizing the interpolated images comprises performing a singular value decomposition.

7. A system (100) for appearance-based object detection, the system comprising:

a training unit (170) for training images comprising at least one of eigenimages and pseudo-eigenimages; and

a detection unit (180) responsive to an input image, which input image has a different brightness and contrast than the trained images, for detecting objects corresponding to the trained images.

8. A system (100) as defined in Claim 7 wherein the input image comprises a single-photon emission computed tomography image.

9. A system (100) as defined in Claim 7, further comprising:

a CPU (102) in signal communication with said detection unit (180) for processing the input image.

10. A system (100) as defined in Claim 9, further comprising:

a display adapter (110) in signal communication with the CPU (102) for displaying the input image; and

an I/O adapter (112) in signal communication with the CPU (102) for recalling the locations of the objects detected in the input image to provide an indication of the location of the detected object within the input image.

11. A system (100) as defined in Claim 9, further comprising:

a user interface adapter (114) in signal communication with the CPU (102) for at least receiving a selection decision for at least one image from a user.

12. A system for brightness and contrast normalization in appearance-based object detection, the system comprising:

extraction means for extracting a plurality of training images;

finding means for finding eigenimages corresponding to the training images;

receiving means for receiving an input image;

forming means for forming a projection equation responsive to the eigenimages;

solving means for solving for intensity normalization parameters;

computing means for computing the projected and normalized images;

fitting means for computing the error-of-fit of the projected and normalized images;

thresholding means for thresholding the error-of-fit; and

determining means for determining object positions in accordance with the thresholded error-of-fit.

13. A system as defined in Claim 12 wherein said finding means comprises:

sub-sampling means for sub-sampling the training images;

training means for forming training images of coarse resolution in accordance with the sub-sampled images;

eigenimaging means for computing eigenimages corresponding to the training images of coarse resolution;

interpolating means for interpolating the eigenimages for coarse resolution;

orthonormalization means for performing orthonormalization on the interpolated images by singular value decomposition; and

pseudo-eigenimaging means for providing pseudo-eigenimages corresponding to the orthonormalized images for a finer resolution.

14. A system as defined in Claim 12 wherein at least one of said plurality of training images and said input image comprises a single-photon emission computed tomography image.

15. A system as defined in Claim 12 wherein the computed error-of-fit is represented by a score image.

16. A system for forming eigenimages for multiresolution, the system comprising:

sub-sampling means for sub-sampling a plurality of training images;

training means for forming training images of coarse resolution in accordance with the sub-sampled images;

eigenimaging means for computing coarse eigenimages corresponding to the training images of coarse resolution;

interpolating means for interpolating the coarse eigenimages for a finer resolution;

orthonormalizing means for orthonormalizing the interpolated images; and

pseudo-eigenimaging means for providing pseudo-eigenimages corresponding to the orthonormalized images for a finer resolution.

17. A system as defined in Claim 16 wherein said orthonormalizing means comprises decomposition means for performing a singular value decomposition.

18. A program storage device readable by machine, tangibly embodying a program of instructions executable by the machine to perform method steps for brightness and contrast normalization in appearance-based object detection, the method steps comprising:

extracting a plurality of training images;

finding eigenimages corresponding to the training images;

receiving an input image;

forming a projection equation responsive to the eigenimages;

solving for intensity normalization parameters;

computing the projected and normalized images;

computing the error-of-fit of the projected and normalized images;

thresholding the error-of-fit; and

determining object positions in accordance with the thresholded error-of-fit.

19. A program storage device as defined in Claim 18 wherein the program step of finding eigenimages comprises:

sub-sampling the training images;

forming training images of coarse resolution in accordance with the sub-sampled images;

computing eigenimages corresponding to the training images of coarse resolution;

interpolating the eigenimages for coarse resolution;

performing orthonormalization on the interpolated images by singular value decomposition; and

providing pseudo-eigenimages corresponding to the orthonormalized images for a finer resolution.

20. A program storage device as defined in Claim 18 wherein at least one of said plurality of training images and said input image comprises a single-photon emission computed tomography image.

21. A program storage device as defined in Claim 18 wherein the computed error-of-fit is represented by a score image.

22. A program storage device readable by machine, tangibly embodying a program of instructions executable by the machine to perform method steps for forming eigenimages for multiresolution, the method steps comprising:

sub-sampling a plurality of training images;

forming training images of coarse resolution in accordance with the sub-sampled images;

computing coarse eigenimages corresponding to the training images of coarse resolution;

interpolating the coarse eigenimages for a finer resolution;

orthonormalizing the interpolated images; and

providing pseudo-eigenimages corresponding to the orthonormalized images for a finer resolution.

23. A program storage device as defined in Claim 22 wherein the program step of orthonormalizing the interpolated images comprises performing a singular value decomposition.